

CLAIMS

What is Claimed Is:

- 1 1. A pressure vessel capable of withstanding elevated hydrostatic pressures, and  
2 elevated temperature comprising:
  - 3 a tubular casing capable of withstanding extreme hydrostatic pressures having  
4 an internal cavity and,
    - 5 an opening in at least one end permitting access to said internal cavity, said  
6 internal cavity having a hollow interior and
      - 7 a plug region near said opening, a plug in said plug region,
      - 8 a component in said hollow interior having at least a first lead passing through  
9 said plug to exit the pressure vessel, said plug encapsulating said component lead and  
10 sealing said opening.
  - 1 2. The pressure vessel of claim 1 wherein the plug region is circular in cross  
2 section.
  - 1 3. The pressure vessel of claim 1 wherein the plug region is circular in cross  
2 section, at least a portion of said plug region having a cross section diminishing in  
3 diameter with distance from said opening.
  - 1 4. The pressure vessel of claim 2 wherein the internal cavity has a circular cross  
2 section, the plug region being necked down match the internal cavity circular cross  
3 section.
  - 1 5. The pressure vessel of claim 1 wherein the lead exiting the opening is at least  
2 a first optical fiber having an optical core covered by optical cladding.
  - 1 6. The pressure vessel of claim 1 wherein the plug region is circular in cross  
2 section, at least a portion of said plug region having a cross section diminishing in  
3 diameter with distance from said opening,
    - 4 the lead exiting the opening being at least a first optical fiber having a plastic  
5 jacket covering the cladding, a region of the plastic jacket passing through the plug  
6 being treated to remove the jacket thereby exposing the cladding, the plug being  
7 formed from adhesive encapsulating a portion of the exposed cladding.

1      7.     The pressure vessel of claim 6 wherein the plug region has an irregular surface  
2     region for frictionally engaging said plug.

1      8.     The pressure vessel of claim 6 wherein the plug region has an irregular surface  
2     region for frictionally engaging said plug, the irregular region being threaded.

1      9.     The pressure vessel of claim 1 wherein the plug is formed from a ceramic  
2     adhesive.

1      10.    The pressure vessel of claim 1 wherein the plug is formed from a ceramic  
2     adhesive, said plug having an external surface, and wherein said pressure vessel  
3     further comprises:

4                a cap, said cap being formed from a polymer material to cover and extend  
5     beyond the external surface of said plug thereby forming a fluid barrier over the  
6     surface of the plug.

1      11.    A pressure vessel capable of withstanding elevated hydrostatic pressures, and  
2     elevated temperature comprising:

3                a tubular cylindrical casing capable of withstanding extreme hydrostatic  
4     pressures having an internal cavity and,

5                an opening in at least one end permitting access to said internal cavity, said  
6     internal cavity having a hollow interior and

7                a cylindrical plug region near said opening,

8                a component in said hollow interior having at least a first lead,

9                a plug in said plug region, the plug having an outer cylindrical surface, the  
10    outer cylindrical surface of the plug being force fit into the plug region opening of the  
11    cylindrical casing, the plug having a through-hole, for receiving and passing at least  
12    the component first lead to a position outside of the pressure vessel, the plug further  
13    comprising:

14          a ceramic adhesive plug formed in the through-hole by inserting ceramic  
15    adhesive into the through-hole and filling substantially all of the void space within the  
16    through-hole not occupied by the lead, the adhesive being allowed to encapsulate the  
17    lead passing through the through-hole, thereby sealing the opening.

1       12.     The pressure vessel of claim 11 wherein the adhesive is a ceramic adhesive  
2     and wherein the tubular cylindrical casing and the plug are formed of steel, the plug  
3     further comprising:

4                 an O-ring positioned in a channel machined in the plug to receive the O-ring,  
5     the O-ring and channel being characterized to provide a seal between the outer  
6     cylindrical surface of the plug and the plug region.

1       13.     The pressure vessel of claim 11 wherein the through-hole is circular in cross  
2     section, at least a portion of said plug region having a cross section diminishing in  
3     diameter with distance from said opening.

1       14.     The pressure vessel of claim 12 wherein the through-hole is circular in cross  
2     section, at least a portion of said through-hole has a cross section diminishing in  
3     diameter with distance from said opening,

4                 the lead exiting the opening being at least a first optical fiber having a plastic  
5     jacket covering the cladding, the plastic jacket of the optical fiber passing through the  
6     through-hole being treated to remove a portion of the jacket, thereby exposing the  
7     cladding, the adhesive encapsulating a portion of the exposed cladding to seal the  
8     through-hole.

1       15.     The pressure vessel of claim 12 wherein the through-hole has an inner surface,  
2     at least a portion of the inner surface being formed to have an irregular surface region  
3     for improved bonding with the ceramic adhesive plug.

1       16.     The pressure vessel of claim 14 wherein the ceramic adhesive plug formed in  
2     the through-hole of the plug has an outer surface and wherein said pressure vessel  
3     further comprises:

4                 a cap, said cap being formed from a polymer material to encapsulate the  
5     exposed cladding and to cover and extend beyond the external surface of said ceramic  
6     adhesive plug thereby forming a fluid barrier over the surface of the plug.

1       17.     A pressure vessel capable of withstanding elevated hydrostatic pressures, and  
2     elevated temperature comprising:

3        a tubular cylindrical casing capable of withstanding extreme hydrostatic  
4        pressures having an internal cavity and a first and second opening at each end  
5        permitting access to said internal cavity, said internal cavity having a hollow interior  
6        and

7        a cylindrical plug region extending inward from said first and second opening,  
8        an optical component in said hollow interior having at least a plurality of  
9        optical fiber pigtails extending from said optical component,

10      a first and second plug in inserted into respective first and second plug  
11     regions, each plug having an outer cylindrical surface, the outer cylindrical surface of  
12     each respective plug being force fit into its respective plug region opening of the  
13     cylindrical casing, at least one plug having a through-hole for receiving and passing at  
14     least a portion of the plurality of optical fiber pigtails to a position outside of the  
15     pressure vessel, the plug further comprising:

16      an adhesive plug formed in the through-hole by inserting adhesive into the  
17     through-hole and filling substantially all of the void space within the through-hole not  
18     occupied by the optical fiber pigtails, the adhesive being allowed to encapsulate the  
19     optical fiber pigtails passing through the through-hole, thereby sealing the opening.

1        18.      The pressure vessel of claim 17 wherein

2        the tubular cylinder casing and the first and second plugs are formed of steel  
3        and wherein at least a portion of said through-hole has a cross section diminishing in  
4        diameter with distance from said opening,

5        the optical fibers exiting the opening being at least a first and second optical  
6        fiber having a plastic jacket covering the cladding, the plastic jacket of the optical  
7        fiber passing through the through-hole being treated to remove a portion of the jacket,  
8        thereby exposing the cladding, the adhesive being a ceramic adhesive applied and  
9        hardening to encapsulate a portion of the exposed cladding to seal the through-hole.

1        19.      The pressure vessel of claim 18 wherein the through-hole has an inner surface,  
2        at least a portion of the inner surface being formed to have an irregular surface region  
3        for improved bonding with the ceramic adhesive plug.

- 1       20. The pressure vessel of claim 18 wherein the ceramic adhesive plug formed in  
2 the through-hole of the plug has an outer surface and wherein said pressure vessel  
3 further comprises:  
4              a cap, said cap being formed from a polymer material to encapsulate a small  
5 portion of exposed cladding extending from said external surface, the cap being  
6 formed to cover and extend beyond the external surface of said ceramic adhesive plug  
7 thereby forming a fluid barrier over the surface of the plug.